U.S. Surgeon General's Office. Historical Division

HISTORY OF PREVENTIVE MEDICINE

IN THE

WESTERN PACIFIC BASE COMMAND

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It is emphasized that all statistical data in this monograph are tentative and subject to revision when tabulation of individual sick and wounded report cards has been completed.

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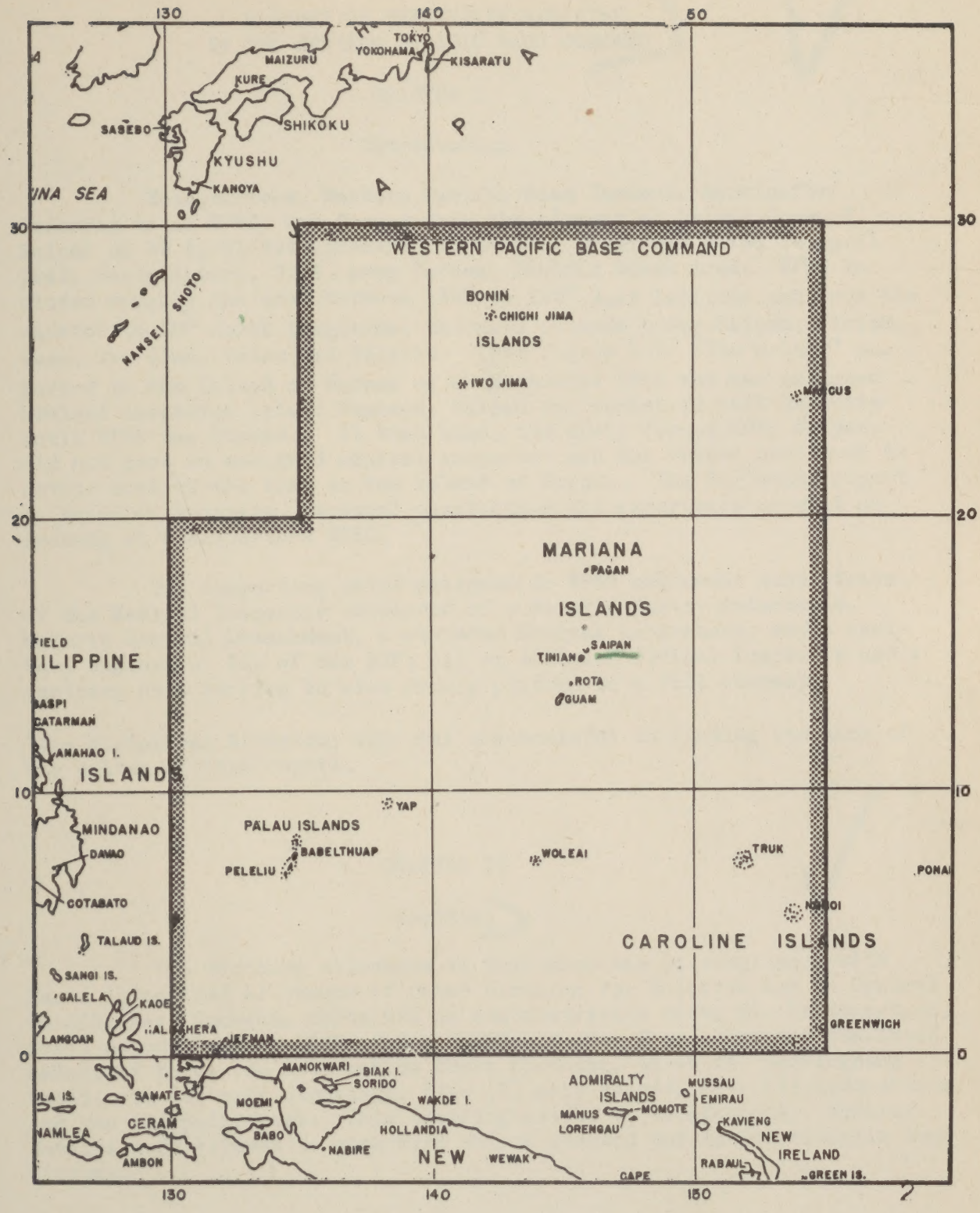
TABLE OF CONTENTS

		Page
Chapter I	Introduction	1
Chapter II	Clothing	1
Chapter III	Housing	2
Chapter IV	Nutrition	3
Chapter V	Personal Hygiene	4
Chapter VI	Water Supply	7
Chapter VII	Disposal of Waste	17
Chapter VIII	Control of Insects	19
Chapter IX	Control of Rodents	39
Chapter X	Immunization	39
Chapter XI	Intestinal Infections	41
Chapter XII	Infections of the Respiratory Tract and Infections Transmitted by Discharges from the Respiratory Tract	41
Chapter XIII	Venereal Diseases	41
Chapter XIV	Arthropod-Borne Infections	47
Chapter XV	Miscellaneous Infections	57
Chapter XVI	Diphtheria	59
Chapter XVII	Nutritional Diseases	59
Chapter XVIII	Environmental Diseases	59
Chapter XIX	Extra-Military Sanitation and Liaison Activities	61
Chapter XX	Civil Public Health	63
List of References		67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ISLANDS
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HANSEI
SHOTO
MARIANA
PAGAN
ISLANDS
SAIPAN
TINIAN
ROTA
GUAM
FIELD
ILIPPINE
ISLANDS
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HISTORY OF PREVENTIVE MEDICINE IN THE WESTERN PACIFIC BASE COMMAND

CHAPTER I

Introduction

Headquarters, Western Pacific Base Command, hereinafter referred to as WPBC, was formed from the element of Island Command Saipan on 25 April 1945 pursuant to General Order #43 dated 14 April 1945, Headquarters, U. S. Army Forces, Pacific Ocean Area. WPBC included roughly the area between 130° to 155° east latitude and from the equator to 30° north longitude, the main islands being Saipan, Tinian, Guam, Iwo Jima, Palau and Peleliu. (See figure 1.) (The writer* reported to the Island of Saipan on 28 September 1944 and was assigned Medical Inspector Island Command, Saipan and worked in that capacity until WPBC was formed.) At that time, the newly formed AGF, Saipan, did not have an assigned medical inspector and the writer continued to devote most of the time to the Island of Saipan. The following report is based on intimate, personal observation and experience as well as records at Headquarters WPBC.

The supporting units assigned to WPBC and under supervision of the Medical Inspector consisted of a Malaria Survey Detachment, Malaria Control Detachment, a numbered Medical Laboratory, and a sanitary engineer. All of the AGFs had an assigned Medical Inspector and a sanitary unit varying in size from a platoon to a full company.

*The Historical Division, SGO, was unsuccessful in finding the name of the writer of this report.

CHAPTER II

Clothing

The clothing allowance in this area was in compliance with Basic Authorized Allowance of Outer Clothing for Enlisted Men in Central Pacific Base Command, contained in Administrative order #1, Headquarters, CPBC, dated 20 March 1945, Index CPYQM-114.20. This allowance consisted mainly of three (3) sets cotton khaki clothing, three (3) herringbone twill, six (6) pair stockings, five (5) pair shorts, five (5) undershirts, and two (2) pair shoes. This clothing proved to be adequate. Working details were allowed to work with shirts removed due to the climatic conditions.

CHAPTER III

Housing

Housing was generally uniform and was at all times adequate and consistent with the general development of the islands. In the early phases pup tents were used for a short time as were some of the remaining civilian buildings.[1] Following the pup tent phase, pyramidal tents were used, housing four officers and six to eight enlisted men per tent.[2]

Wooden floors were provided for the pyramidal tents as lumber became available. Construction of prefabricated buildings and Quonset huts for the housing of troops was begun as soon as materials were available and the program progressed rapidly until practically all troops were in semipermanent buildings. The allocation of space in the semipermanent buildings was 48 square feet for enlisted men and 80 to 320 square feet per officer.[3]

Originally, all hospitals consisted of ward tents with wooden or coral floors and floored and screened operating rooms. Semipermanent construction was begun at an early date and the progress was in conformity with general development on the islands.

Messes and kitchens.--Improvised screened kitchens were used until semipermanent construction could be accomplished. All of the kitchens had concrete floors with adequate drains and some of the combined kitchens and mess halls had complete concrete floors. (See figure 2.)

A Standard Kitchen

Standard Mess Hall

Figure 2

CHAPTER IV

Nutrition

During the assault phase, K and C rations were used and the B ration issued as soon as units were provided with fly-proof kitchens even though they were of a makeshift variety.[4] The amount of fresh food as a supplement to the B ration varied some but the island of Saipan generally was representative of the fresh food issued. Saipan received its first shipment of fresh food on D plus 136 and during the period from June 15 to December 31, 1944 had received the equivalent of about ten days of fresh food per man.[5]

This fresh food supplement consisted of fruits, meat, vegetables, butter, and eggs. Following this period, fresh food was constantly available and at least one fresh food meal a day was served. There was no evidence of nutritional disease but there was a uniform weight loss of the command.[6]

The consumption of food including fish, dairy products, meat, as well as fruits and vegetables that would not necessarily be cooked before eating was prohibited until definite control could be established.[7]

The islands gradually took advantage of the fresh fish, vegetables, and fruits that were available from native and Foreign Economic Administration sources. On Saipan fresh fish were accepted from native fisherman beginning in June 1945 and an average of forty tons of fish was issued per month.[8] Fish available consisted of bonita and mackerel and the processing was closely supervised. Fish were iced as soon as they were caught, cleaned, and re-iced upon arrival at the pier.

Fresh fruit and vegetables produced under FEA supervision were accepted for Quartermaster issue and the supply was adequate. Ice cream manufactured from standard ice cream mixture was a welcome addition to the menu. It was manufactured both by individual units and centralized ice cream plants. On the island of Saipan a central system was in operation and the issue which began in February 1945 was gradually increased until it was issued once a week to general troops and four times per week to the hospital.[9]

The quartermaster bakery began functioning early and constantly furnished a good bread for all troops.

Several moderately severe food poisonings were experienced, but none were of particular interest. All of these occurrences were investigated and all found to be due to the faulty handling of food following preparation and none due to food being defective at the time of issue.

CHAPTER V

Personal Hygiene

Personal hygiene in general was very satisfactory and the health of the command was excellent. (See tables 1, and 2.)

Fungus infections were rather numerous but considering the climatic conditions in the area, were not an unreasonable number. Bathing facilities varied considerably and gradually progressed from the use of steel helmets to standard semipermanent showers. (See figure 3.) In the early phase, many improvised showers were constructed with the use of 55 gallon drums, and rain water was plentiful. As the water supply was developed, there was always an adequate amount of chlorinated, unfiltered water for shower purposes in addition to the completely processed water which included chlorination and filtration.

Standard Washroom & Shower

Standard Latrine

Figure 3

TABLE 1.--Diseases

Saipan (APO 244)		
(1944)	No. of Cases	Rate per 1000 per Annum
September	4,153	1393.26
October	559	213.74
November	253	86.55
December	262	65.42

TABLE 2.--Diseases

	W.P.B.C.		Saipan (APO 244)	
(1945)	No. of Cases	*Rate	No. of Cases	*Rate
January	456	39.90	202	61.07
February	608	51.10	298	81.19
March	725	47.68	387	79.21
April	960	72.18	294	78.33
May	1176	86.45	331	88.79
June	1744	101.39	548	114.84
July	1704	123.80	516	148.90

*Rate: (per thousand per annum)

CHAPTER VI

Water Supply

SAIPAN[10,11,12]

a. Topography.--Saipan is roughly 14 1/2 miles long by 3 1/2 miles wide (See Topographic map).[12] It is extremely hilly throughout, with a peak of 1500 feet elevation in the center. There are flat areas at the north and south ends, and along the west coast at the Kagman Point peninsula.

b. Geology.--Ground structure consists principally of a shallow earth overlay over coral, with lesser areas of red clay and volcanic rock. Cavernous ledges abound.

c. Rainfall.--Annual rainfall averages eighty (80) inches, falling chiefly from July to November.

d. Sources of water:

(1) The only perennial surface water on the island was Lake Susupe, too saline to be used as a source of potable water supply. There were no streams, due to the porosity of the coral ground structure.

(2) The Japanese utilized springs, shallow wells, and roof run-off as sources of water. Several springs developed by them became part of the island water supply. Many of their shallow wells were used at the civilian internment camp. In areas removed from springs and wells, concrete cisterns for storage of rainwater were provided. Rainfall was collected from one of their flight strips by gutters and stored in underground reservoirs.

(3) After the U. S. invasion, Japanese sources were utilized after purification, and the drilling of deep wells was begun. Distribution points were provided with elevated storage in wood-stave tanks, and the installation of mains was begun, to decrease haulage by trucks. Japanese reservoirs and pipe lines were used wherever possible.

(4) Excellent deep wells were drilled at Isely Field and Chacha soon after invasion, and their number was increased steadily with the development of the island's facilities. One year after invasion, thirty (30) drilled wells were in service. They

varied in depth from 50 to 400 feet. All were equipped with turbine-type deep-well pumps, gasoline engine driven, of 30, 60, and 200 gallons per minute (gpm) rated capacity. Water from the deep drilled wells was generally of excellent bacteriological quality, but hard. It was struck in three different geological formations:

(a) At sea level, when a layer of basal fresh water floats on salt water.[13]

(b) In an artesian stratum considerably below sea level.

(c) Perched several hundred feet above sea level.

Basal water at sea level was subject to salt water intrusion if the draught was excessive; safe draught was determined by experience. Deep wells in certain areas yielded brackish water under any appreciable draught. These were used as sources of non-potable water for washing and bathing.

(5) Many former Japanese wells were used, plus several newly dug ones. They invariably yielded water of high salinity because of their proximity to the ocean, due to the mixing of the fresh water layer and the underlying salt water caused by tidal fluctuations in water level.

(6) Springs.--Eight springs were developed by U. S. troops, seven of which were used as sources of potable water; one was non-potable because of its salinity. All springs showed appreciable bacteriological contamination in spite of proper construction to exclude surface water.

(7) Infiltration tunnels.--Three infiltration tunnels were started in the spring of 1945. They consist of horizontal unlined tunnels in coral at sea level, designed to skim the layer of fresh water floating on salt water.[10,13] One was abandoned early, another did not develop any appreciable supply of water while the third was successfully completed in July 1945. It was 400 feet in length and yielded 2.4 million gallons per day (gpd) of excellent water, low in salinity. An adjustable weir was provided at the pump sump to control the depth of skimming, to prevent the intrusion of brackish water.

(8) Roof catchments.--Two extensive roof areas were fitted with gutters, piping, and storage to collect rain water for non-potable uses. The larger installation comprised 13 acres of roof area, and supplied a QM laundry during rainy weather. The other installation had a roof area of four acres. No data are available as to their annual yield. Obviously, it was impractical to provide sufficient storage to hold torrential downpours of any duration, so but a part of the annual rainfall could be collected. Small roof catchments were installed by various units in several instances to augment their supply from the main island water supply.

(9) The following table summarizes the capacity of the various types of sources.

	Number of Sources	Capacity gallons per day
Potable water		
Springs	7	270,000
Shallow wells	0	0
Deep wells	18	1,890,000
Infiltration Tunnel*	1	2,448,000
TOTAL	26	4,608,000
Non-Potable water		
Springs	2	160,000
Shallow wells	13	1,322,000
Deep wells	12	772,000
Roof catchments	3	No data
TOTAL	29	2,254,000
Total, All Sources:		
Springs	9	430,000
Shallow wells	13	1,322,000
Deep wells	30	2,662,000
Roof catchments	3	No data
Infiltration Tunnel*	1	2,448,000
	56	6,862,000

*Completed but not placed in service.

e. Distribution of water.--Since occupation of the island, water mains were continually extended to supply all heavily populated areas with piped water. (See map of distribution system.)[12]

(1) Approximately two-thirds of all water consumed was piped from the source to the points of consumption, and one-third hauled by tank trucks from distribution points. There were seven distribution points for potable water and two for non-potable water.

(2) Rationing.--Minimum allowances of water were established as follows 20 January 1945:[14]

(a) Five gallons per person daily.

(b) Hospital patients, 30 gallons per patient daily.

(c) Units having their own supply of non-potable water were allowed 5 gallons per man daily of potable water.

Non-potable water was available in practically unlimited quantities. On 22 February the allowance was increased to 10 gallons per man per day,[14] but in June 1945 it was reduced to 8 gallons per man daily. None of the army hospitals had adequate water supply to permit the use of installed flush toilets.

(3) Storage.--Storage reservoirs of 15.25 million gallons total capacity were a part of the water distribution system. This figure does not include innumerable small tanks in unit areas. 13.0 million gallons of storage were provided in underground reservoirs constructed by the Japanese, and 2.25 million gallons in wood-stave tanks above ground, erected by U. S. troops. Two reservoirs of 11.6 million gallons total capacity were used exclusively to supply ships.

(4) Many of the first laid water mains were of wood-stave pipe. It proved unsatisfactory because of continued leakage, and was systematically replaced. Some Japanese transite mains were used after occupation by U. S. troops, but they failed under the pressures imposed upon them by U. S. pumping installations. One stretch of 10" Jap transite main had to be replaced because of failure of the cast-steel couplings. One year after invasion, the central water distribution system consisted of the following lengths of mains:

4" steel and cast iron	6.1 mi
6" steel and cast iron	6.75 mi
12" steel and cast iron	0.6 mi
8" Transite	3.3 mi
12" Transite	1.25 mi
4" Wood-stave	1.65 mi
6" Wood-stave	2.00 mi
8" Wood-stave	2.00 mi
12" Wood-stave	1.0 mi
TOTAL	24.65 mi

In addition, the following lengths of installed wood-stave mains were not in service: 6 inches, 1 1/2 miles; 8 inches, 1 3/4 miles; 12 inches, 6 1/2 miles.

(5) Pumps.--All pumping units were driven by gasoline engines and after long use presented serious maintenance difficulties due to lack of spare units and parts.

f. Water Consumption.--By mid-1945, average daily water consumption was as follows:

	Total G.P.D.
Potable Water	1,550,000
Non-Potable Water	680,000
TOTAL	2,230,000

This was roughly equivalent to 14 gallons per day of potable water and 7 gallons per day of non-potable water per man, exclusive of hospital patients.

g. Quality of water.--Immediately after invasion, routine tests were made for heavy metals and poisons, but were discontinued after conditions indicated they were no longer necessary.

Routine bacteriological examinations were made of all potable waters. Until August 1945 samples were collected by the units operating the various components of the water supply, and examinations were made by a general hospital laboratory. In August 1945, when operation of the Island water supply was taken over by the Navy, collection and examination of water samples were made by a Naval epidemiology laboratory.

There were no outbreaks of water-borne diseases.

Bacteriological quality of potable waters was generally satisfactory. Hardness of waters ranged from 200 to 450 parts per million (ppm). Salinity of potable waters did not exceed 30 grains per gallon of NaCl except in a few instances.

h. Treatment.--Potable deep-well waters were chlorinated regularly to maintain a minimum residual of 1.0 ppm at the source. Because of the use of wood tanks and mains, and because of varying volumes in storage, chlorine residuals were not always present at points of use.

Potable spring waters were always treated by coagulation, filtration, and chlorination, in four treatment installations. Portable and mobile Corps of Engineers equipment was in use continually. Later a Navy knock-down type rapid sand filter was installed at one source. A concrete rapid sand filter was constructed at another source. Only two of four filtration installations provided sedimentation prior to filtration, as required[16] in areas where amoebic dysentery was prevalent.

Non-potable water for showers and washing was required to have a residual chlorine content of 3.0 parts per million after 30 minutes contact.[15] Two distributing points on the central island water supply system provided no such treatment, but relied upon the consuming units to apply chlorine manually. Four unit sources provided no such treatment.

Corps of Engineers mechanical equipment for filtration and chlorination was difficult to maintain because of lack of spare units and parts. Three gas type chlorinators, recently installed, eliminated much of this difficulty.

i. Summary.--In spite of operational difficulties due to lack of equipment, spare units, and spare parts, water supply at this island was adequate in volume for minimum needs except in temporary, isolated cases. Absence of outbreaks of water-borne diseases speaks for its quality.

TINIAN[17]

a. This island, about 40 square miles in area, is unlike its neighbor, Saipan, in that its topography is rolling, with no precipitous slopes except at the shore. Like Saipan, the ground structure is largely coral.

b. The only body of surface water was Hagoi Lake, with its surface about two feet above sea level. It was grossly contaminated, and brackish, and was used as a source of non-potable water for laundry and washing uses.

(1) An excellent source of potable water supply existed in the Marpo Valley, an extensive sink-hole with its

floor just above sea level. Here basal fresh water, floating on salt water, was almost at ground level. A Japanese installation consisting of a concrete-lined dug well 30 feet in diameter and 10 feet deep, pumping station with duplicate Diesel driven pumps each of 1100 gmp capacity, and a 97,000 gallon concrete storage reservoir, was early put in use by U. S. troops. It yields 592,000 gpd of water of 145-165 ppm chloride content. At Tiniantown, a Japanese deep dug well was in use, but its yield (20,000 gpd) was small.

(2) Basal fresh water near sea level was drawn from 19 drilled wells by gasoline engine driven turbine-type pumps and stored in wood-stave tanks at roadside distributing points. Pumping rates varied from 15 to 65 gpm. Their water was of excellent bacteriological quality and their salinity was low.

(3) In the Marpo Valley sink-hole, an infiltration gallery was constructed. It was situated at a location where ground water level was near the surface, and consisted of a long trench with its invert below ground water level. A double row of perforated steel drums was laid end to end, terminating in a collecting sump at one end. The trench was refilled with crushed stone, and diked and ditched to exclude surface water.

c. Distribution.--About one-half of the water consumed was delivered by tank trucks. A general piped distribution system was about 75 percent completed. Piping was steel. Pressure was approximately 50 pounds per square inch. The 97,000 gallon Japanese reservoir mentioned in paragraph 2, b, (1) provided storage.

d. Water consumption.--The average daily water consumption reached 1,430,000 gpd in July 1945. This was equivalent to 22 gallons per man daily.

e. Quality of water.--Weekly bacteriological samples of water were examined by the laboratory of a general hospital. Potable water was consistently of excellent quality.

f. Treatment.--All water was hypochlorinated. Non-potable water from Hagoi Lake had a minimum residual chlorine content of 1.0 ppm. Potable water averaged 0.84 ppm residual chlorine at the points of delivery.

g. Summary.--This island was blessed with an ample supply of water of excellent quality, capable of development without any engineering difficulties.

IWO JIMA[18]

a. Water supply was a unique problem here from the start. Not only were geological conditions unusual, but the concentration of such large numbers of troops on so small an area presented complications.

b. At the south end of the island is Mt. Suribachi, a small active volcano. At the northern end of the island the rough terrain consists of volcanic tuff. The central portion of the island is flat, and consists of a fine volcanic sand. There is no surface water on the island. The northerly end of the island exudes steam through fissures in the ground, and latrine pits in certain areas must be ventilated to prevent burning of patrons.

c. The Japanese had collected rainfall from the air strip, as at Saipan, and had fitted condensing heads over steam outlets to augment their supply. Drinking water was obtained only from distillation units, the volume produced reaching 75,000 gpd. To provide water for washing and bathing, wells were drilled and dug. Several shallow dug wells furnished highly brackish water. Deep drilled wells, striking water at about 10 feet above sea level, produced water of varying quality except one well which yielded only steam. The volcanic sand in which they were drilled was excellent protection against surface contamination.

d. Quality of water.--All deep well water varied in temperature from 120° F to 180° F, averaging 140° F. No deep well water was potable, for varying reasons. In some, chloride content was too high, all had excessive iron and silica contents, one had a magnesium content of 70 ppm, and one contained 1.7 ppm of hydrogen sulfide. Aeration for cooling formed "red water," or iron hydroxide. All were bacteriologically excellent, due either to the nature of the soil or to the high temperature of the ground water.

e. Treatment.--Distilled water was treated with lime to eliminate its corrosive qualities. All water was chlorinated. Drinking water had a residual chlorine content of 1.5 to 2.0 ppm at the point of distribution. Deep well water was aerated to reduce its temperature, and chlorinated. Residual chlorine content averaged 0.5 ppm at points of use. Two filter plants were constructed for removal of iron from deep wells.

f. Distribution.

(1) At first, all distribution was by tank trucks. A distribution system for supplying well water to all units was 75 percent completed by August, 1945.

(2) Water was rationed as follows:

(a) Drinking water: 3 gallons per man daily.

(b) High quality non-potable water (deep wells): 3 gallons per man daily, used for culinary purposes and washing mess gear.

(c) Brackish water: Unlimited distribution.

(3) Deep well pumps presented a unique problem. Turbine type pumps, of 30 gmp capacity, operated satisfactorily, but reciprocating pumps could not be used because of failure of plunger washers at the prevailing high temperature of water. Field improvisation of substitute material finally solved the problem.

CHAPTER VII

Disposal of Waste

Human.--The straddle trench latrines were replaced with standard latrine boxes which were for a time without a protective house. As lumber became available, standard semipermanent latrines were constructed. Fly control was effected by the use of sodium arsenite in the early phases of operation but due to the possibility of contaminating the water supply, this was discontinued and the standard latrine oil mixture was used. PDB (paradichlorbenzene) was later available and proved most satisfactory for latrine fly control. (See memorandum PDB.) Some few installations including the hospitals have water-borne sewage systems but the deep pit latrine was in general the standard. (See figure 4.) The water-borne system consisted of a septic tank from which the untreated effluent was piped to the sea.

Trash.--Combustible trash was burned either in unit areas or centralized trash dumps, while the noncombustible trash was either disposed of at sea or authorized trash dumps which were controlled and covered with dirt to prevent fly and mosquito breeding. (See figure 4 and Memorandum No. 6.)

Garbage.--The system of garbage disposal varied considerably, but three main disposal methods were used. The sanitary fill was used when other methods of disposal were not practical. The second method consisted of disposal at sea by use of a barge to take the garbage beyond the reef. The third and most desirable method was disposal directly into the sea from the shore. (See figure 4.) This method was dependent upon having an adequate current in order to carry the garbage out to sea. The system used in this area for direct disposal at sea along with the method of washing and steam cleaning garbage cans has been previously reported.[19,20]

Shower water.--Shower water was disposed of by use of standard soakage pit which consisted of a rock-filled pit with a ventilator and a cover of earth.

Kitchen waste water.--The disposal of kitchen liquid waste presented a problem due to coral formation and difficulty in digging adequate soakage pits. The system used generally consisted of an improvised grease trap usually made out of 55 gallon drums and a soakage pit. (See figure 5.) When a semipermanent camp was occupied for a considerable period of time, the kitchen and mess tended to become a problem due to the spilling of waste water on the ground. Most kitchen liquid wastes contained some food as did the water used for washing of mess gear and over a period of time ground contamination was inevitable and fly breeding became a problem. A concrete deck 15 by 20 feet, with a 6 inch lip,

adequate slope, and a drain, would have prevented this ground contamination. This deck is of adequate size to contain the garbage cans, one or two sets of cans for mess kit laundry, and can be used for washing pots and pans if the kitchen facilities were not adequate for this purpose. (See Memorandum, and figure 6.)

MEMORANDUM)
NUMBER 73)

10 October 1944

PARADICHLORBENZENE

1. PDB, Paradichlorbenzene is now available and will be used for latrine fly control and for its deodorant effect. PDB, a volatile white crystaline substance, is convenient to use and is extremely effective in fly control. It will be used in place of all other chemicals and latrine sprays.

2. The effectiveness of PDB is due to the formations of gas. Too weak a concentration is not effective and too high a concentration is irritating to the skin. The following precautions are necessary.

a. Dirt must be kept around base of latrine box to prevent the escape of gas.

b. Latrine box must be made as air tight as possible by sealing large cracks and knot holes and by maintaining well fitting seat covers.

c. Ventilators and fly trap vents must be closed.

3. The amount of PDB necessary will vary somewhat with the depth of the pit and the following is the recommended amount to be used.

Three (3) ounces of PDB per latrine hole twice a week. In a standard eight (8) hole latrine the amount necessary twice a week (24 ounces) is equivalent to the contents of a #2 1/2 can. PDB should be uniformly sprinkled over the base of the pit, and the lumps should be broken up.

4. PDB will be issued by Quartermaster on the basis of fifteen (15) pounds per 100 men per month and battalions or larger units will draw in lots of 200 pounds in the original container. Smaller units will draw their monthly requirement and will supply a suitable container.

5. Since PDB is perishable it must be properly stored in a suitable container to assure dryness and prevent the escape of gas.

By command of Major General JARMAN:

G. M. O'CONNELL
Colonel, G.S.C.
Chief of Staff

OFFICIAL:

R. O. DANIELSON,
Captain, Adjutant General's Department
Assistant Adjutant General.

DISTRIBUTION:"E"

HEADQUARTERS ISLAND COMMAND
SAIPAN

MEMORANDUM)
:
NUMBER 6)

12 January 1945

TRASH DUMPS AND GARBAGE DUMPS

1. The following directive rescinds all previous memorandums and directives published on this subject.

2. Five authorized trash dumps and three garbage dumps have been established on this Island. Dumping of trash and garbage will be confined to these dumps. All organizations will haul their waste to the most readily accessible dumps to their camp areas regardless of arm or service operating the dumps.

Approved trash and garbage dumps are located as follows:

a. Trash Dumps:

No. 1. TA 227-T&Y & TA 228-P&U (S.E. Pier "B" Tanapag).
No. 2. TA 260-M&R (S.E. of RJ 55).
No. 3. TA 177-S (near C.R. 172).
No. 4. TA 102 K (West side Nafutan Point).
No. 5. TA 142-O&J (near RJ05).

b. Garbage Dumps:

No. 1. TA 117-M (Agingan Point).
No. 2. TA 292-M (Marpi Point).
No. 3. TA 180-X (Rorogattan Point).

c. Trash dump No. 5 and garbage dump No. 1 are now in operation. Readiness dates for the other dumps will be announced in later Bulletins.

3. Segregation of trash and garbage will be as follows:

a. To go to trash dumps:

(1) All combustible items of waste.

(2) General debris not otherwise classified.

b. To go to garbage dumps:

(1) Liquid garbage.

(2) Flattened cans.

(3) Glass and bottles (broken).

(4) Small non-combustible items that will not float in water.

c. To go to scrap metal dumps:

(1) All scrap metal.

4. The attendant on any trash or garbage dump will refuse any loads of waste not properly segregated and report unit.

5. Dumping of all waste will be between the hours of 0700 and 1600.

6. Operation of Island Trash Dumps.

a. Trash dumps will be operated on the principle of concentrated dumping and controlled burning.

b. As part of the responsibility of operating an Island Trash Dump, the Commanding Officer of a unit assigned the operation of a trash dump shall:

(1) Be responsible for controlling the burning of trash to insure that all trash is burned and that no fires continue to burn after dark.

(2) Be responsible for extinguishing all fires in the dump.

(3) Post signs, barriers and take other action considered necessary to prevent dumping of trash except between the hours of 0700 and 1600.

(4) Have dump attendants make inspections of trash being dumped to prevent any explosives or other unauthorized waste being dumped.

c. Fire fighting equipment, such as pumps and hose with nozzles, with sufficient capacity to extinguish all fires in the dump prior to night fall will be installed and operated by the unit assigned the operation of the trash dump.

7. Operation of Island Garbage Dumps.

a. All garbage will be dumped into the ocean. Only waste as will not float will be dumped at the garbage dumps.

b. As part of the responsibility of operating an Island Garbage Dump, the Commanding Officer of a unit assigned the operation of a garbage dump shall:

(1) Post signs, barriers and take other action considered necessary to prevent dumping of garbage except between the hours of 0700 and 1600.

(2) Have dump attendants make inspections of garbage to prevent any combustible waste or other waste that would tend to remain afloat for long periods from being dumped.

(3) Keep dump area policed.

c. Boilers, steam lines and water lines provided for cleaning the garbage cans will be operated and maintained by the units assigned the operation of the dump.

d. The washing and steaming of the garbage cans will be the responsibility of the unit dumping. The unit operating the dump will provide supervision only.

8. Organizations assigned the operation of the various Island Trash Dumps are as follows:

Trash Dump No. 1. TA 228-P&U, CO, Naval Base.

" " No. 2. TA 260-M&R, OinC, 101st NCB.

" " No. 3. TA 177-S, CO, East Field.

" " No. 4. TA 102K, CO, Prov. Air Base #1.

" " No. 5. TA 142-O&J, CO, 1398 Engr Cons Bn.

9. Organizations assigned the operation of the various Island garbage dumps are as follows:

Garbage dump No. 1. TA 117-M, CO, 1878 Engr Avn Bn.

" " No. 2. TA 292-M, CO, 101st NCB.

" " No. 3. TA 180-X, CO, East Field.

By command of Major General JARMAN:

G. M. O'CONNEL,
Colonel, G. S. C.,
Chief of Staff.

OFFICIAL:

/s/ C.E.Richardson
C. E. RICHARDSON,
Lt. Col, A. G. D.,
Adjutant General.

DISTRIBUTION: A & B

View of garbage disposal, Saipan

Trash dump, Saipan

Figure 4

Standard Grease Trap

Soakage Pit

Figure 5

HEADQUARTERS ARMY GARRISON FORCE
APO 244

MEMORANDUM)
:
NUMBER 80)

16 October 1944

MESS KIT WASH RACK

1. Plans have been prepared by and are available at Headquarters, 1176th Engineer Construction Group for a standard mess kit wash stand, garbage can rack, and grease trap.

2. All future construction of these facilities will be in accordance with that plan (#G-255). Units having sanitary facilities approved by the medical inspectors are not required to revise their installations.

3. All units not having adequate sanitary facilities will install them in accordance with above plan without delay.

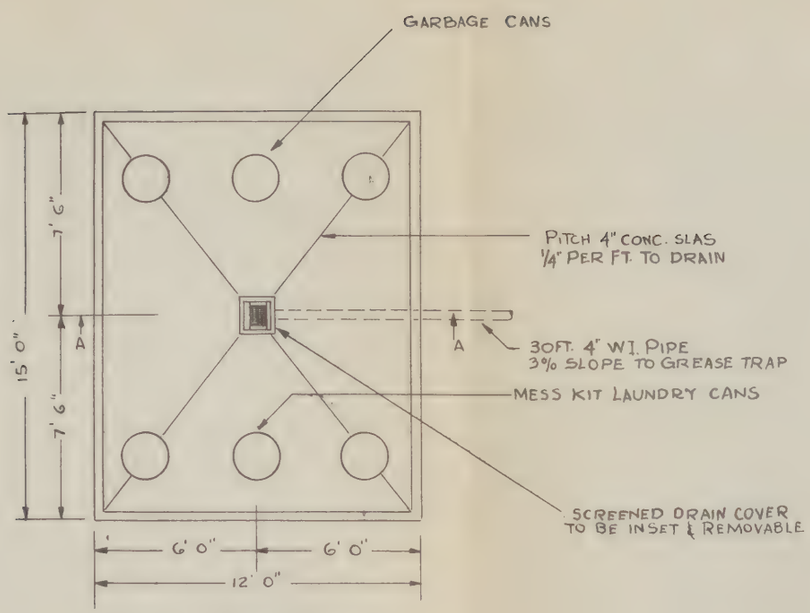
By command of Major General Jarman:

G. M. O'CONNELL
Colonel, G.S.C.
Chief of Staff

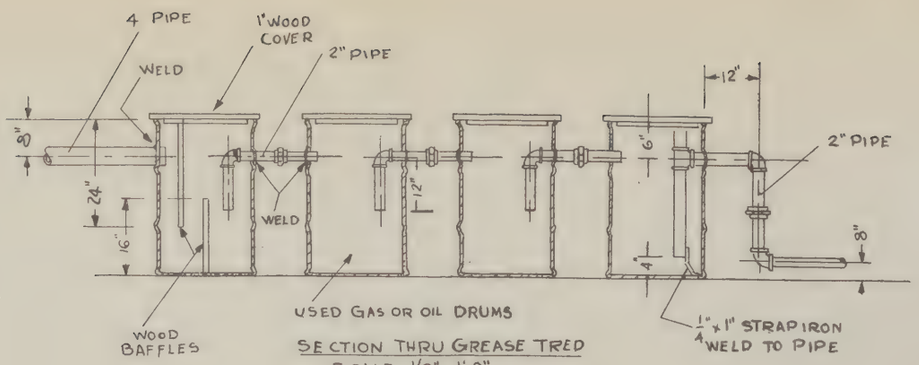
OFFICIAL:

JAMES D. BAILEY JR.
Major, Adjutant General's Department
Adjutant General

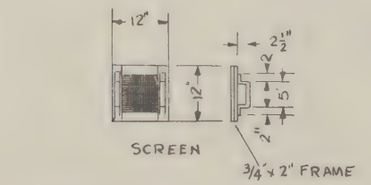
DISTRIBUTION: E



PLAN OF WASH STAND

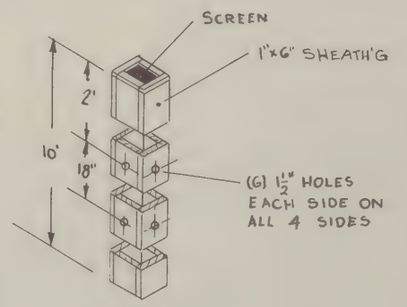


SECTION THRU GREASE TRED
SCALE 1/2" = 1'-0"

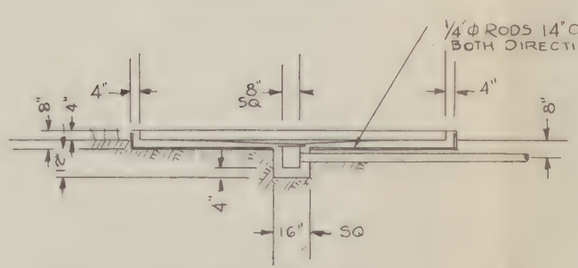


2 HANDLES
MAKE FROM 5" x 3/4"
STRAP IRON
FASTEN WITH 2" 0 SCR.

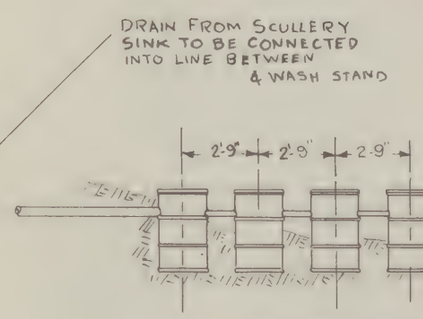
DETAIL OF DRAIN COVER
SCALE 1/2" = 1'-0"



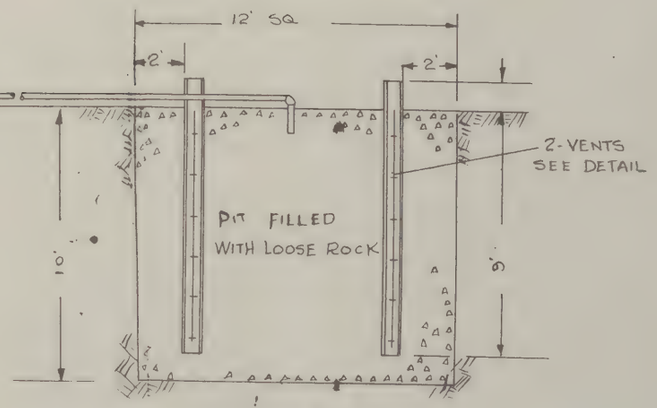
DETAIL OF VENT
SCALE 1/8" = 1'-0"



SECTION A-A



SECTION THRU GREASE TRAP



SECTION THRU SUMP

NOTE! DIMENSIONE OF WASH & GARBAGE CAN STAND

MESS HALL SIZE	SIZE OF STAND
20, 60, 100 MAN	12 FT x 15 FT.
150, 200, 250 MAN	12 FT. x 20 FT.
500 MAN	12 FT. x 25 FT.

HEADQUARTERS
FIRST PROV. ENG BRIG.
A.P.O. 244

MESS KIT WASH STAND
GARBAGE CAN RACK & GREASE TRAP

SCALE: 1/4" & 1/2" = 1'0" DATE: OCT. 6, 1944

REVISIONS	BY	CH.	DATE
1. WOOD BAFFLES ADDED	J.R.		Nov. 3, 1944
2. WOOD BAFFLES REMOVED FROM LAST 3 DRUMS PIPING RELOCATED FROM BOTTOM TO TOP OF DRUMS	J.R.	J.W.H.	DEC. 23, 1944

E.S.
DRAWN. J.R.

SUBMITTED BY	APPROVED BY
J C Howland	B A Barnes
CAPT. C.E. R.B.	COL. C.E. O.F.
DESIGN. SEC.	COMMANDING

SH. 1 OF 1 SH.

FILE NO.

G-255

Standard concrete deck with garbage can
and 2 sets of mess gear wash cans.

Standard kitchen deck in use.

Figure 6

CHAPTER VIII

Control of Insects

Prior to American occupation of the islands in the WPBC, information as to the kinds of medically important insects which occurred and their relative abundance, importance to man, and biology was fragmentary and conflicting. Much data has since been accumulated.

The islands as a group have a meager development of medically important insects. The entire area lies outside of the limits of distribution of the Anopheles mosquitoes and is malaria-free. Other mosquitoes were weakly represented and, except for certain widespread and presumably introduced species, were of importance only as pests so far as is known at present. Only a small number of fleas, ticks, chiggermites, and biting-flies were known to occur. Authoritative identifications for many of these species have not been obtained and some are presumably undescribed species.

The following brief summary of surveys of these islands includes only the data collected by the 217th Malaria Survey Detachment.

SAIPAN

Of the nine species of mosquitoes collected on Saipan, three were important because of their ability to carry disease or as pests. These were Culex quinquefasciatus, a night-biting semidomestic mosquito which was a vector of filariasis among the natives and an outstanding pest; Aedes albopictus, a day-biting semidomestic mosquito which is a vector of dengue and an abundant pest mosquito; and Aedes aegypti, a well-known dengue vector, and a potential vector of yellow fever.

Aedes aegypti, which was reported as a common mosquito in the early months of the occupation, was apparently very rare or extinct by 15 November 1944, the date of the detachment's arrival on the island. No specimens were collected on Saipan. Though no data as to the reason for its disappearance were obtained, it is assumed that the combination of the destruction of villages and cities, the complete displacement of the native population, and the inception of control measures, created such an unfavorable situation that this most domestic of mosquitoes was unable to survive. Such semidomestic mosquitoes as Culex quinquefasciatus and Aedes albopictus bred abundantly about the demolished and abandoned dwellings and in the battle debris which littered the island, and were the most common mosquitoes on the island.

The removal of battle debris, destruction of cisterns, the covering over of demolished dwelling and town sites by construction activities, and the work of the sanitary units on the ground had greatly

decreased the available breeding sites of these two mosquitoes with a consequent large decrease in the adult biting population.

The other mosquitoes were of little significance because of their rarity or because of their restricted habitat. Successful stocking of ponds and marshes with gambusia-fish greatly reduced the numbers of Culex annulirostris, a local and minor pest mosquito. Day-biting forms in the native vegetation were infrequently encountered. All the other biting insects and arthropods were rarely encountered.

Since it has been found that Aedes aegypti were either entirely extinct or exceedingly rare on Saipan, considerable importance was attached to the possible role of Aedes albopictus, which is according to current literature a vector of dengue in certain parts of the world, and is the only mosquito left on Saipan which is a possible vector.

The following was stated in a letter from the 217th Malaria Survey Detachment, to the Commanding Officer, 18th General Medical Laboratory, APO 957, Subj: "Miscellaneous Entomological Problems," 23 August 1945: ". . . we feel, after a study of its (Aedes albopictus) habits on Saipan, that it could not be an important vector here. We find the larvae in treeholes and tin cans under vegetation. The adults can be found only in vines and banana groves by shaking the foliage, whereupon they come out and bite (daytime), if the human is within a few feet of their resting place. If the human moves a few yards away, the mosquitoes give up and retire. They are not aggressive biters and do not leave the vegetation to come around quarters and camps. Apparently they can exist without human blood meals because we found them common at Garapan, months after all natives had left the area. Our tentative conclusion is, therefore, that there can be no epidemic of dengue on Saipan at the present."

In the first indorsement to the above letter, from the Commanding Officer, 18th General Medical Laboratory, 31 August 1945, the following comment was made: "Our observations on Saipan in regard to the breeding and feeding habits of Aedes albopictus agree in every respect with yours, and it is deemed unlikely indeed that another dengue epidemic will occur there in the absence of Aedes aegypti. . . ."

TINIAN

Conditions on Tinian had a marked similarity to those on Saipan. Culex quinquefasciatus and Aedes albopictus, formed the major control problem. There was considerably less battle debris on the island, due to the relative ease and speed of the occupation and thus much less potential breeding situations for these mosquitoes than on Saipan. All other mosquitoes were scarce or local and were pests only under certain conditions as, for example, to working parties or patrols in the native vegetation.

One lot of Aedes aegypti larvae was collected in a rain barrel in the civilian camp. Judging by the control measures in use there, this already rare mosquito could maintain but a precarious foot-hold on Tinian.

GUAM

The most important difference, with respect to the situation on Tinian and Saipan, was the apparently complete absence of Aedes albopictus on Guam, and the fact that Aedes aegypti was maintaining itself in the native villages (by verbal communication with NAMRU #2). In addition, the woodland and pond and pool mosquitoes were abundant pests in the forested areas. One tick, Amblyomma cyprium, Newman, was frequently encountered in the native vegetation. It attached readily to humans.

PALAU ISLANDS

No insect-borne diseases were known on the three southern islands, Peleliu, Angaur, and Garakayo, briefly surveyed by members of the 217th Malaria Survey Detachment.

The main insect pest was the biting gnat-fly, Culicoides pelelioensis. It was very abundant and caused intense itching by its bites. Control was directed entirely at killing the larvae by means of DDT dust applied to the mangrove-swamp margins which formed the extensive breeding sites. Mosquitoes were uncommon except for Culex quinquefasciatus.

Chigger-mites were collected both on Peleliu and upon Garakayo. On the latter island they were so abundant that a day spent in the brush would result in scores of painful and itching bites on the lower parts of the body.

IWO JIMA

Only one pest-insect, Culex quinquefasciatus, was noted on this island during a brief survey made in September 1945 by a member of the 217th Malaria Survey Detachment. It was uncommon at that time.

A survey of transport planes arriving at Saipan was made by this detachment between 16 December 1944 and 31 January 1945. Of 88 planes inspected, 72 contained insect remains and 22, or 25 percent, contained live insects. These planes had been sprayed with freon-pyrethrum aerosol en route. Live insects were collected from 6 planes from 1-4 weeks after these had been sprayed with DDT. Two of these, moreover, were also sprayed with aerosol prior to landing.

A total of 23 dead culicine mosquitoes, representing at least 5 species, were collected. These included a species, Theobaldia inornata,

not found in these islands. No anophelines, dead or alive, were collected from the 21 planes which came from a malarial region (Leyte).

A total of 1050 insects were collected during the survey. Many belonged to widespread species injurious to plant and animal products.

Conclusions were that present methods of de-insectizing planes were permitting live insects to be transported from other areas to Saipan in sufficient numbers to render undesirable introductions and their successful establishment on Saipan, probable.

The following species were found alive on transport planes: Cock roaches, 3 specimens; gnat-fly (probably Culicoides pelelioensis) on plane from Peleliu; flies, 17 specimens; beetles, 8 specimens; wasps and ants, 9 specimens; 1 truebug; moths 2, spider 1, fly maggot 1.

Since dengue existed on the island of Saipan, Guam, and Tinian an adequate mosquito control program was instituted. Control measures used on the various islands were rather similar and since Saipan presented the greatest problem, the methods of control used on Saipan are discussed.

During the period in which the island was under assault, 15 June to 9 July 1944, the dry season was still present, mosquitoes were relatively scarce, and, consequently, the incidence of dengue was very low. However, thousands of artificial breeding containers, such as cisterns, tree-holes, empty shell cases, cans, and shell holes, were present in the war torn areas of Charan Kanoa, Garapan and around Isely Field.[21] With the start of the rainy season in July, these containers were continually filled with water and all mosquitoes multiplied rapidly, including the dengue carriers, Aedes aegypti and Aedes albopictus. Estimated dengue rates shown by the detachment of the 18th Medical Laboratory in its report for the week ending 17 September, show a steady rise to a high of 5834 cases per thousand per annum in the week ending 26 August, dropping to a rate of 3500 on 13 September at which time accurate records were started. (See graph 1.)

During the early phases of the campaign it was virtually impossible to start the necessary cleanup work because of combat conditions and shortage of personnel.[22] One platoon of the 743d Medical Sanitary Company arrived on 25 June and started a program of mosquito control by cleaning up trash, spraying cisterns with kerosene and stocking wells with top-feeding minnows. Units engaged in cleaning up their own areas and starting construction work also eliminated many mosquito breeding places. The preliminary mosquito survey of the island was carried out jointly by the entomologist of the Pacific Division of the Air Transport Command, who arrived on 20 August, and the epidemiological team of the 18th Medical General Laboratory, which arrived on 3 September. Graph 1

TABLE 3

Biting Insects And Other Arthropods Collected by 217 MSD in WPBC Mosquitoes	Marianas Saipan)	 Tinian)	 Guam)	Palau Peleleiu)	 Angaur)	 Garakayo)	 Iwo Jima	Larval Habitat
Culex quinquefasciatus Say	x	x	x	x	x	x	x	artificial containers, foul water
C. annulirostris Skuse	x		x					ponds, marshes, artif. containers
C. sp. nr. Annulirostris ?		x						marsh
C. littoralis n.sp. mss.		x						brackish pools on rocky coast
C. jepsoni (Theob.)			x					" "
C. jepsoni ?				x				brackish swamp
C. sp. (subg. Lophoceraomyis?)						x		pandanus axil
Aedes albopictus Skuse	x	x						artif. containers, tree-holes
Aedes aegypti (Linne)		x						rain barrel in civilian camp
A. vexans Meigen	x	x	x					temporary pools, ruts etc.
A. oakleyi Stone			x					road rut
A. oakleyi ?	x							slit trenches in woods
A. saipanensis Stone	x							tree-holes, pandanus axils, art. containers
A. pandani Stone			x					pandanus axils
A. sp. nr. pandani	x	x						pandanus axils
A. sp. scutellaris grp.	x							tree-holes
A. guamensis F. & B.			x					tree-holes
A. sp. 1 nr. niveus				x		x		coconut shells, tree holes, cans etc.
A. sp. 2 (hebrideus?)				x		x		coconut shells, wood keg
A. sp. 3 (subg. Finlaya)					x	x		pandanus axils
A. sp. 4 nr. niveus				x		x		tree-holes
A. sp. 5 nr. amesii ?				x				ammo-tin
Aedomyia sp.				x	x			
Gnat-fly								
Culicoides peleliouensis				x		x		mangrove swamps
Horse-fly								
Tabanidae sp.				x				
Biting flies								
muscoid	x		x					
Fleas								
Ctenocephalides felis?	x							
Ticks								
Amblyomma cyprium			x					
Rhipicephalus sp.	x							
Cattle-tick sp.	x							
Chigger-mites								
Schongastia?sp.				x		x		

shows adult mosquito biting records taken between 20 August and 3 November, indicating that the peak of adult mosquito incidence was reached during the week ending 5 September.

On 3 September, a supply of DDT dissolving powder was received by air express, and the decision was made to use this DDT dissolved in kerosene in the form of an airplane spray over the most heavily populated areas. An M-10 chemical warfare service smoke tank was suspended from the bottom of the plane fuselage to act as a venturi tube. Seven 55 gallon oil drums were placed on their sides in the fuselage, connected in series and piped to the M-10 tank through a one and one half inch pipe with a control valve. The equipment was tested on 12 September and the selected areas on the south and west of the island were sprayed between 13-22 September. The plane was flown at an altitude of 50-100 feet, at a speed of 140 miles per hour, and over swaths of about 100 yards in width. It was found that a cross wind of not more than 6-8 miles per hour was desirable to distribute the spray over the 100 yard swath with some overlapping. An area of 15,650 acres was sprayed with 8,600 gallons of insecticide, at an average dosage of 2 quarts per acre. A marked reduction of adult mosquitoes was noted within a few days, and without doubt a great many of the infected mosquitoes were killed off, so that a further rise in dengue rates was prevented. On 14 September, residual spraying of quarters with DDT kerosene insecticide was started, using a truck-mounted chemical warfare decontaminator power spray. Other improvised power sprayers as well as hand sprayers were used by island units, and the insecticide was applied at an average rate of 1 quart per 250 square feet of surface.[23]

From September through December 1944, the Sanitary Company continued to do the following mosquito control work: dusting of cisterns and wells with 10 percent DDT in talc, destruction of cisterns and wells, filling tree holes, and residual spraying of buildings and tents at about 6 week intervals. The 115th Malaria Control Detachment arrived on Saipan on 29 November 1944, and after assisting the 217th Malaria Survey Detachment in a mosquito survey of the island, started mosquito control work by temporarily controlling cisterns with DDT kerosene or waste motor oil and the destruction of can dumps and cisterns where possible. Waste motor oil at the rate of about 4 gallons per cistern was found to give a longer residual larvacidal effect than either DDT in kerosene or DDT in talc used as a dust. On 6-7 November, another portion of the island was sprayed by plane with 5,000 gallons of spray.

During January, the Sanitary Company continued the residual spraying of buildings, larviciding of cisterns and swamp areas and cleaning up of trash dump areas. From February through August this unit continued the residual spraying of buildings and the mixing of DDT solutions for use in airplane spraying and for issue to organizations doing their own spraying. The Malaria Control Detachment continued the temporary

oiling of cisterns and spraying of can dumps from January through March and then, with the aid of a crew of native laborers, started the destruction and permanent control of the cisterns. This was done by draining, filling, use of dynamite or use of a bulldozer wherever possible. In March a program of checking unit areas for mosquito breeding was initiated, calling the attention of each commanding officer to deficiencies noted.

Memorandum No. 70, Headquarters, Island Command, Saipan, subject: "Insect and Rodent Control," was issued on 10 May 1945. This memorandum called for the formation and training of insect and rodent control details of one enlisted man per company and one responsible insect and rodent control officer per battalion or similar unit. From 14 June to 14 July, a series of three day courses in insect control was conducted jointly by the malaria control and survey detachments. The total attendance at 9 classes was 35 officers and 241 enlisted men from 84 units. Subjects taught were: (See Outline of Insect Control Measures, 115th Malaria Control Detachment.)

Insect-borne diseases of Saipan
Mosquito collection and identification
Methods of permanent mosquito control
Insecticides for temporary mosquito control
Insecticiding equipment

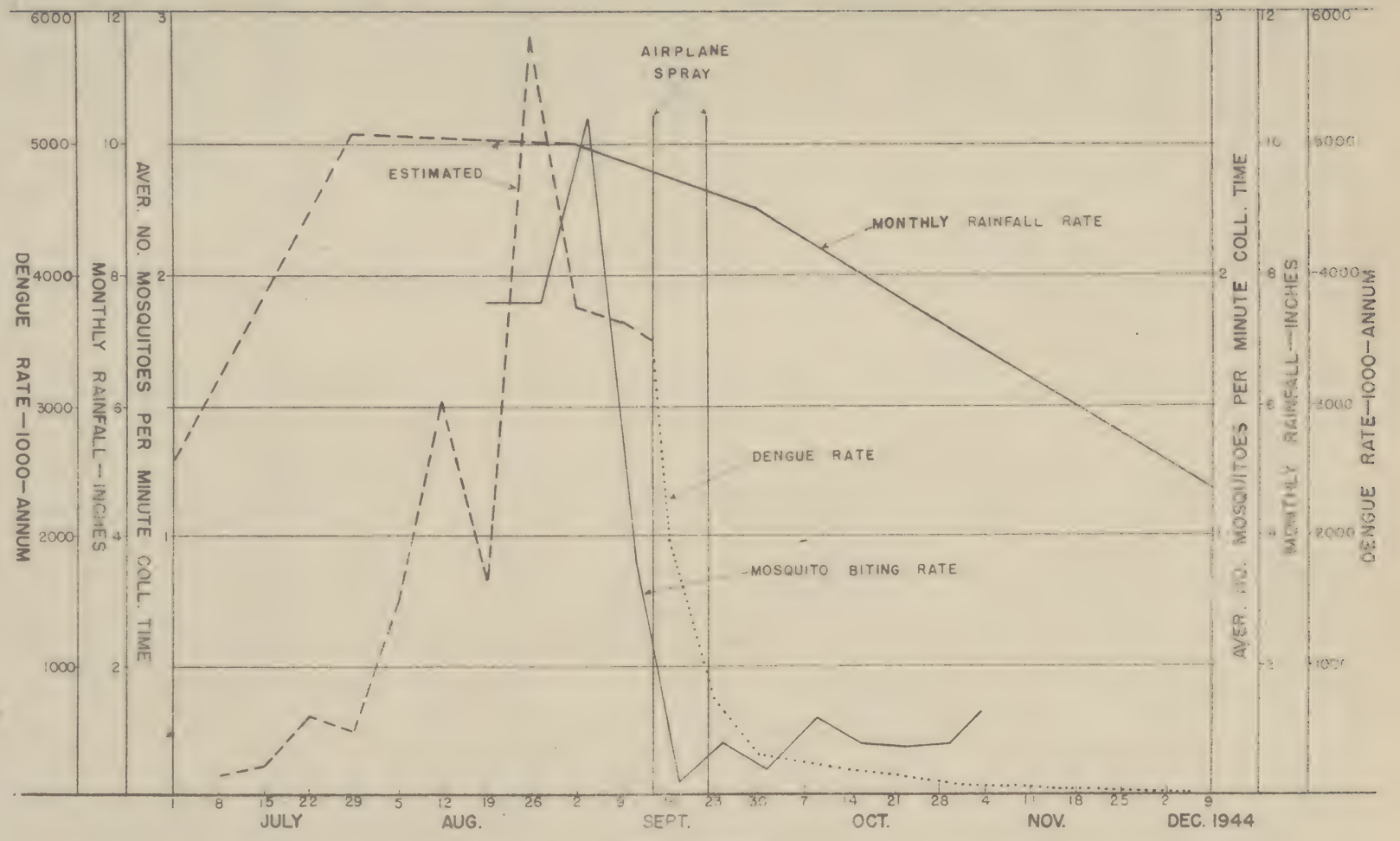
The memorandum restated the War Department policy concerning a unit commander's responsibility for insect control within the unit area and that the malaria control detachment would advise units concerning such work and be responsible for all work outside of unit areas. The malaria survey detachment would make routine surveys of each area to determine the effectiveness of control.

In July a Navy epidemiological unit arrived on the island and assumed responsibility for the supervision of all Naval unit insect control activities. In February portions of the island were again sprayed by air. Six 100 gallon plastic tanks on wood cradles were substituted for the oil drums and the M-10 smoke tanks was replaced by an improvised horizontal venturi tube about 18 inches long, having a flared inlet and a spreader plate on the outlet end. This was fed by gravity from a vertical 2 inch pipe connected to the storage tanks. These plastic tanks were unsatisfactory because of the small, complicated piping arrangement and the long filling time required. The venturi tube gave a satisfactory droplet size and spray pattern. In April the entire island was sprayed for the first time, covering about 48,000 acres with 25,000 gallons of insecticide. This time the plane was fitted with two 335 gallon light weight, bomb bay fuel tanks, with 2 inch piping connections, and retaining the same venturi tube under the plane. This last arrange-

ment proved entirely satisfactory and was used on later flights during July and August.

In August a number of power sprayers were made available at the engineer depot for issue to units on the basis of one per 2,000 troops. These sprayers were used for residual spraying primarily on a one month cycle.

With the cleanup of the debris, filling of cisterns and wells, and the training of units to keep their areas in good condition, the application of a residual DDT spray to all building and tent surfaces once a month, and the spraying of the island by plane occasionally, the pest mosquitoes can be kept to a minimum and there should be no danger of another dengue epidemic breaking out.



MOSQUITO CONTROL—SAIPAN, 1944

GRAPH I

TABLE 4.--Mosquito Control Work

115th Malaria Control Detachment and 743d Medical Sanitary Company

1944	Jul	Aug	Sep	Oct	Nov	Dec	Total
Cisterns & Wells Dusted with DDT				2,502	438	640	3,580
Cisterns & Wells Sprayed with DDT						296	296
Cisterns & Wells Oiled with Waste Oil						377	377
Cisterns & Wells Stocked with Fish	562	893					1,455
Cisterns & Wells Destroyed		30		263	59	70	422
Tree Holes Filled				1,647	677	939	3,263
Can Dumps Dusted With DDT						27	27
Can Dumps Sprayed With DDT						88	88
Can Dumps Destroyed						95	95
Buildings Sprayed With Residual DDT			1,120	3,895	3,418	2,080	10,513
Acres Sprayed by Plane			15,650		5,000		20,650
Quantity DDT Dust (Pounds)				800	190	133	1,123
Quantity DDT Residual Spray (Gallons)			780	1,950	1,860	1,487	6,077
Quantity DDT Issued to Organizations (Gal)					680	1,600	2,280
Quantity DDT Plane Spray (Gallons)			8,600		10,500		19,100
Quantity Waste Motor Oil (Gal)						850	850

TABLE 4.--Mosquito Control Work (Continued)

1945	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total	Grand Total
Cisterns & Wells Dusted with DDT										3,580
Cisterns & Wells Sprayed with DDT										296
Cisterns & Wells Oiled with Waste Oil	814	362	315	188	10				1,689	2,066
Cisterns & Wells Stocked with Fish										1,455
Cisterns & Wells Destroyed	87			357	386	313	5	49	1,197	1,619
Tree Holes Filled										3,263
Can Dumps Dusted with DDT										27
Can Dumps Sprayed with DDT	38	1	45	8	12	5	11	31	151	239
Can Dumps Destroyed				15	43	5	1		64	159
Tires Sprayed with DDT							6,500	9,500	16,000	16,000
Buildings Sprayed with Residual DDT	1337	1961	3271	2662	652	1209	956	1,342	13,390	23,903
Acres Sprayed by Plane		7565		48000			48,000	24,000	127,565	148,215
Quantity DDT Dust (Pounds)										1,123
Quantity DDT Residual Spray (Gal)	942	1440	2115	1520	660	2500	1,100	815	11,092	17,169
Quantity DDT Issued to Organizations (Gal)	769	263	210	3630	720	1935	815	6,210	14,552	16,832
Quantity DDT Plane Spray (Gal)		3450		25000			25,000	12,500	65,950	85,050
Quantity Waste Motor Oil (Gal)	2140	493	936	638					4,207	5,057

115th MALARIA CONTROL DETACHMENT
APO 244

OUTLINE OF INSECT CONTROL MEASURES

I. MOSQUITO CONTROL.

A. Permanent Control Measures.

1. Routine Camp Sanitation.

a. Artificial breeding containers.

(1) Maintenance of authorized water containers.

(a) Fire Barrels - tight-fitting covers & oil film.

(b) Rain Barrels - eliminate numerous small cans.
Closed containers with faucets.
Tight-fitting screen covers.

(c) Water Tanks, Cisterns & Wells in use - Tight-fitting covers.

(2) Maintenance of Trash Barrels. Drain holes in bottom and covers.

(3) Drain or fill unused Cisterns & Wells.

(4) Disposal of Trash at Authorized Dumps.

(a) Tin Cans.

(b) Ammunition Containers.

(c) Tar and Oil Drums.

(d) Scrap Metal.

(5) Maintenance of Stored Miscellaneous Equipment.

(a) Tires - Cover or spray weekly.
(b) Small Boats - Covered, drained or sprayed weekly.
(c) Truck & Trailer Bodies and Construction Equipment - Covered, drained or sprayed weekly.

(d) Oil Drums - Store on Side.

(e) Canvas or Paulins - Drained.

I. MOSQUITO CONTROL (CONT'D).

A, 1.

b. Natural Breeding Areas.

(1) Swamps, Pot Holes, Pools & Ponds - Fill, drain, or stock with fish.

(2) Road Ruts - Fill, drain or spray temporarily.

(3) Ditches.

(a) Adequate drainage, including installation of culverts.

(b) Elimination of pollution in open ditches.

(1) Grease traps on kitchen waste lines.

(2) Installation of soakage pits, rock filters & sewage treatment plants where necessary.

(4) Tree Holes - Fill or drain.

2. Maintenance of Screened Buildings.

a. Proper construction of screened windows and doors.

b. Closing of all apertures.

c. Repair of screening.

B. Temporary Control Measures.

1. Types of Temporary Control.

a. Larval Stage.

b. Adult Stage.

(1) Immediate or Contact Kill.

(2) Residual Applications.

2. Insecticides For Temporary Control.

I. MOSQUITO CONTROL (CONT'D).

B, 2.

a. Waste Motor Oil - Used against larvae.

b. No 2 Diesel Oil - Used against larvae.
c. Kerosene - Used against larvae.
d. DDT - Used against larvae & adults. (Contact & residual). Supply - WD Cir No 151, dtd 17 April 44.

(1) Dissolving Powder - QM Stock No 50-L-120, Larvicide, DDT, powder, dissolving.

(2) Kerosene Spray - QM Stock No 51-1-305, Insecticide Spray, DDT, residual effect.

(3) Emulsion - QM Stock No 51-I-310, Insecticide, spray delousing.

(4) Dust - QM Stock No 51-L-122, Larvicide, DDT, powder.

e. Individual Control Measures.

(1) Freon Aerosol Bombs - Adult contact kill.

(2) Repellents.

3. Insecticiding Equipment.

a. Continuous Hand Sprayer, QM Stock No 41-S-4106, Sprayer, liquid, insect, continuous spray.

b. Three gallon Decontamination Sprayer, CWS, Apparatus, decontaminating, 3-gal capacity, M-1.

c. Five gallon knapsack sprayer, Engineer Stock No 41-7839.5-5, Sprayer, insect, knapsack type, 5-gal cap.

d. Power Sprayers.

(1) Eng Stock No 40-9030.6-3, Sprayer, insect, portable, gasoline engine driven, for larvicide, with four 50 ft lengths of 3/8" oil resistant hose and spray nozzle.

I. MOSQUITO CONTROL (CONT'D).

B, 3, d.

(2) Sprayer, Paint, Model E-2, Pneumatic with Compressor, Gasoline Engine, Gun, Hose, Tanks, Extension and Tools, as per Corps of Engr's U S Army Tentative Spec. T-1153-C (EDS Cat 786500-000)

(3) Improvised Pressure Drum Type Sprayers.

e. Rotary Dusters - Eng Stock No 41-3115.5-10, Duster, insect, hand rotary blower type, paris green or powder, 5 to 10 pounds capacity.

f. Hand Dusters - QM Stock No 41-D-3750, Duster, insect, powder, plunger type.

g. Aerosol Bomb - QM Stock No 51-I-159, Insecticide, aerosol, one pound dispenser.

II. CONTROL OF OTHER MEDICALLY IMPORTANT INSECTS OF THE PACIFIC OCEAN AREAS.

A. Seriousness of The Problem.

1. The insect-borne diseases constitute the most important communicable disease group in all tropical regions.

2. Insect-borne diseases present and of military importance on this island:

a. Dengue Fever - Transmitted by mosquitoes.

b. Filariasis - Transmitted by mosquitoes. Another, fly-borne, form of filariasis does not occur in the Marianas, but is sometimes encountered in other islands of the Pacific.

c. Dysenteries - Transmitted by flies.

3. Insect-borne Diseases of Potential Importance On This Island:

a. Typhus Fever.

II. CONTROL OF OTHER DISEASES (CONT'D).

A, 3, a.

(1) Mite-borne - Of extreme importance in the islands of Japan.

(2) Flea-borne.

(3) Louse-borne.

b. Plague - Transmitted by Fleas.

4. Insect-borne diseases not found in the Marianas, but encountered in most forward areas of the Pacific:

a. Malaria - Transmitted by Anopheline Mosquitoes.

b. Pappataci Fever - Transmitted by Sand Flies.

B. Nature of Insect-Borne Diseases, and Modes of Transmission.

1. Blood, and more rarely skin, Infections transmitted by Biting Insects.

a. From Man to Man (e.g., Filariasis, Louse-borne Typhus).

b. From Animals to Man (e.g., Plague).

2. Intestinal Diseases, transmitted by Mechanical Contamination of Food (e.g., Dysentery).

C. Control Measures.

1. Flies.

a. Transmit intestinal diseases by the mechanical contamination of food.

b. Biology.

(1) Eggs, laid in feces, garbage or decaying organic matter, hatch in 8 - 24 hours.

(2) Larvae, called maggots, feed on the organic matter. After 4 - 6 days, maggots migrate to drier, cooler place to pupate.

II. CONTROL OF OTHER DISEASES (CONT'D).

C, 1, b.

(3) The pupa, a stage lasting 3 - 10 days, is inactive.

(4) Adult has certain habits which simplify control.

(a) Attracted by odors.

(b) Fly toward light.

(c) Usually rest on vertical surfaces.

c. Control consists chiefly of general sanitary measures.

(1) Feces disposed of in fly-tight latrines, sprayed with a chemical fly-larvicide weekly, and covered with at least 2 feet of hard-packed dirt when closed. (See FM 8-40).

(2) Screening of latrines, mess-halls, and kitchens.

(3) Proper disposal of garbage.

(4) Use of baited fly traps, fly paper, and residual DDT in mess-halls and latrines. DDT dust is highly effective against adult flies.

(5) Fly Larvicides include:

(a) No 2 Diesel Oil.

(b) DDT Solutions.

(c) Sodium Arsenite (Penite-6).

(d) Paradichlorbenzene (PDB).

2. Mites - (Not insects, but closely related to ticks and spiders).

II. CONTROL OF OTHER DISEASES (CONT'D).

C, 2.

a. Form of Typhus (Tsutsugamushi, Scrub Typhus) is transmitted by one species (Trombicula akamushi) which occurs in Japan, New Guinea, Ryukyus, etc.

b. Biology.

(1) Adults free-living, occur in grasses.

(2) Larvae seek animal blood and some bite man.

c. Control.

(1) Impregnation of clothing with dimethyl phthalate repellant (See TB Med 121).

(2) Control of rodents (usually field mice) which serve as animal reservoirs of the disease and as hosts for the larval mites.

(3) Burning of tall grass, especially Kunai grass.

3. Fleas - The rat flea may transmit a form of typhus known as endemic Typhus or murine Typhus, and also transmits Plague. The most effective method is control of the rodent host, but other, more temporary measures are available:

a. DDT residual spraying is effective against fleas in buildings.

b. DDT dusting powder may be used on domestic animals, and is very useful when used in rat harborages.

4. Lice - Transmit epidemic typhus, relapsing fever, trench fever. Human body lice attack man only.

a. Lice are commonly spread in situations where many people are crowded together, and when bathing and laundering are infrequent.

b. Eggs are fastened to body hairs or clothing fibers, and hatch in about 8 days; the lice must have a blood meal within 24 hours after emergence. Adult lice cannot survive more than 8 - 10 days without food.

II. CONTROL OF OTHER DISEASES (CONT'D).

C, 4.

c. Usual control measures consist of bathing and laundering, or dusting with DDT. Clothing may be impregnated with DDT emulsion.

5. Insect Pests.

a. Bedbugs are easily killed by DDT solutions, and 1/2 pint of 5% solution per bed (Including mattress, pillow, frame, etc) furnishes a residual lasting from 6 months to a year.

b. Ants are greatly diminished in numbers in a given building by residual spraying or dusting with DDT.

c. Roaches are usually killed by dusting kitchen and ware-house corners and cracks with sodium fluoride. DDT dust, though not quite as effective against all species of roach, is much safer to use.

/a/John P. Swenson
JOHN P. SWENSON
Capt, Snc
Comdg

REFERENCES - INSECT CONTROL

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Circular No 117, Paragraph IV, 14 April 1945.
Training Circular No 16, 14 April 1945.

TECHNICAL BULLETINS

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Med 14, The Use of DDT As A Mosquito Larvicide, 3 Mar 44.
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Med 87, Data On Malaria Control, 23 Aug 44.
Med 110, Use of DDT As Insecticide To Kill Adult Mosquitoes, 25 Oct 44.
Med 121, Impregnation of Clothing With Insect Repellent (Dimethyl Phthalate), December 44.
Med 134, Data on Malaria Control, January 45.

FIELD MANUALS

FM 8-40, Field Sanitation.
FM 21-10, Military Sanitation & First Aid.

POA AND ISLAND DIRECTIVES

Letter, HUSAF, POA, APO 954, subject: An Organization And Program For The Control of Malaria & Insect-Borne Diseases, 23 Mar 45.
Memo No 70, Hq, Island Command, Saipan, subject: Insect & Rodent Control, 10 May 1945.
Training Memo No 1, Hq, 1109th POA, Prov AGF, APO 244, subject: Insect Control School, 29 May 45.
Memo No 6, changes 1-5, Hq, Island Command, Saipan, subject: Trash Dumps & Garbage Dumps, 12 Jan 45.
Memo No 9, Hq, Island Command, Saipan, subject: Police of Abandoned Areas, 15 Jan 45.

NAVY PUBLICATIONS

Naval Medical School, National Naval Medical Center, Bethesda, Maryland; Laboratory Guide To Medical Entomology with notes on Malaria Control.

United States Pacific Fleet & Pacific Ocean Areas, Hq Of The Commander In Chief; Malaria And Epidemic Disease Control Bulletins Nos 1, 2 & 3, 1945.

CHAPTER IX

Control of Rodents

The islands vary from moderate to heavy infestation with rodents and an active control was instituted early. The species found in the area are Rattus norvegicus, Rattus concolor (exulans), Rattus rufescons, mus musculus, and mus musculus momiyamai. Both live and dead rats have been examined for parasites and disease and no evidence of bubonic plague, of trichinella or of leptospira has been detected; no fleas have been found on rats, and the mites and lice noted have not been identified but are not believed to be of medical importance.

Control measures instituted included the destruction of food supplies and harborages, trapping and especially prebaiting system of poisoning. The poisons used included Red Squill, barium carbonate, thallium sulphate and zinc phosphide. Thallium sulphate was found to be the superior poison due to the fact that itis about 100 percent consumed and is an effective poison. Both the prepared poison oats product and oats locally treated with oil and poison were used successfully. The sanitary units played an active part in the rodent control program and necessary schools in rodent control were organized to teach proper control methods to assigned members of individual units. The control program generally was very satisfactory and the rodent index has been kept to reasonable limits.[24,25]

Specimens of rodents were sent to the Army Medical Museum, and were added to the collections of the U. S. National Museum.

CHAPTER X

Immunization

A constant program of immunization was carried on in accordance with existing directives. Supply of material was constantly adequate and there were no unusual developments.

CHAPTER XI

Intestinal Infections

During the combat phase, flies were very numerous but due to the fact that only K rations were used until screened kitchens could be improvised, the intestinal infections remained comparatively low. As semipermanent camps were constructed adequate sanitation was possible and the intestinal infection rate presented no problem. (See tables 5 and 6, diarrheas - dysentary.)

CHAPTER XII

Infections of the Respiratory Tract and Infections Transmitted by Discharges from the Respiratory Tract

While the incidence of diseases of the respiratory tract varied, there was no marked fluctuation and the increase incidence was noted during the rainy season. There have been no epidemics and no particular problems in this regard. (See tables 7 and 8, respiratory diseases.)

CHAPTER XIII

Venereal Diseases

Venereal diseases have not been a problem in this area due to the fact that all natives, except those of Guam have been constantly segregated from the military personnel. Practically all the cases reported in compliance with existing regulations have been contacted prior to the time of arrival in this area.[26] (See tables 9, 10, and 11, venereal disease.)

TABLE 5.--Diarrheas and Dysentary (all types)

Saipan (APO 244)				
1944	Diarrheas		Dysentary	
	No. of Cases	*Rate	No. of Cases	*Rate
September	171	57.37	78	26.17
October	96	36.71	16	6.12
November	57	19.50	9	3.08
December	89	22.22	4	.99

*Rate: (per thousand per annum)

TABLE 6.--Diarrheas and Dysentary (all types)

W.P.B.C.				
1945	Diarrheas		Dysentary	
	No. of Cases	*Rate	No. of Cases	*Rate
January	63	5.51	17	1.49
February	114	9.57	31	2.61
March	150	9.86	18	1.18
April	323	24.29	28	2.11
May	193	14.19	82	6.03
June	331	19.24	83	4.82
July	142	10.32	66	4.79
		Saipan (APO 244)		
January	39	11.78	7	2.10
February	70	19.07	14	3.81
March	57	11.66	3	.61
April	27	7.17	4	1.05
May	44	11.80	21	5.61
June	50	10.48	24	5.03
July	20	5.69	20	5.69

*Rate:(per thousand per annum)

TABLE 7.--Respiratory Diseases

Saipan (APO 244)						
1944	Common Respiratory		Influenza		Pneumonia (all types)	
	No. Cases	*Rate	No. Cases	*Rate	No. Cases	*Rate
September	289	97.10	--	---	12	4.01
October	127	48.62	--	---	10	3.82
November	114	39.04	--	---	7	2.39
December	112	27.94	--	---	20	4.97

*Rate: (per thousand per annum)

TABLE 8.--Respiratory Diseases

Saipan (APO 244)						
1945	Common Respiratory		Influenza		Pneumonia (all types)	
	No. Cases	*Rate	No. Cases	*Rate	No. Cases	*Rate
January	62	18.32	--	---	8	2.41
February	73	19.87	--	---	15	4.09
March	124	25.37	--	---	29	5.93
April	113	30.10	3	.78	42	11.18
May	131	35.14	--	---	34	9.10
June	240	50.29	--	---	36	7.54
July	266	75.63	2	.57	47	13.36

*Rate: (per thousand per annum)

TABLE 9.--Syphilis

	W.P.B.C.		Saipan (APO 244)	
1944	No. of Cases	*Rate	No. of Cases	*Rate
September	---	--	---	--
October	---	--	2	.76
November	---	--	---	---
December	---	--	5	1.24
1945				
January	26	2.28	20	6.04
February	15	1.26	3	.84
March	50	3.29	30	8.40
April	28	2.11	20	5.31
May	36	2.65	19	5.09
June	59	3.43	27	5.66
July	76	5.52	37	10.52

*Rate: (per thousand per annum)

TABLE 10.--Gonnorhea

	W.P.B.C.		Saipan (APO 244)	
1944	No. of Cases	*Rate	No. of Cases	*Rate
September	---	--	4	1.34
October	---	--	2	.76
November	---	--	2	.68
December	---	--	--	----
1945				
January	4	.35	--	----
February	10	.84	2	.54
March	8	.53	6	1.23
April	17	1.28	4	1.06
May	16	1.17	8	2.14
June	62	3.60	38	7.96
July	57	4.14	31	8.81

*Rate: (per thousand per annum)

TABLE 11.--Other Venereal

	W.P.B.C.		Saipan (APO 244)	
1944	No. of Cases	*Rate	No. of Cases	*Rate
September	---	---	1	.33
October	---	---	1	.38
November	---	---	1	.34
December	---	---	--	---
1945				
January	1	.09	1	.30
February	---	---	--	---
March	1	.07	1	.20
April	---	---	--	---
May	2	.15	2	.52
June	7	.41	--	---
July	5	.37	--	---

*Rate: (per thousand per annum)

CHAPTER XIV

Arthropod-Borne Infections

The arthropod-borne infections of the area of interest consist of dengue and filariasis.

Dengue.--Dengue exists on the island of Saipan, Guam, and Tinian and while all three islands had dengue in the early phases of invasion a major epidemic occurred on the island of Saipan. At the time of the invasion of Saipan (June 15 1944), mosquitoes were present and dengue began to appear among the troops. As this was the dry season, the rate at first was low, but as the rainy season began and the mosquito control measures could not be adequately instituted due to combat conditions, the rate began to climb. By August 11, 1944 mosquitoes were abundant and the dengue rate had reached 300 among the garrison force and continued to climb rapidly reaching a rate of 3500 by 8 September 1944.[27] All possible mosquito control measures were instituted including airplane spraying of 5 percent DDT and the epidemic was brought rapidly under control.[28] (See tables 12 and 13, dengue, and memorandum.)

Filariasis.--While filariasis was present among the natives of Saipan and Tinian it was not a problem from the military standpoint.[29] There was no known case of filariasis contacted on these islands by military personnel and this was, no doubt, due to the low incidence of the disease and the fact that the natives were constantly segregated.[30] A report of the investigation of filariasis by the 217th Malaria Survey Detachment is enclosed.

HEADQUARTERS ARMY GARRISON FORCE
APO 244

MEMORANDUM)
:
NUMBER 63)

2 October 1944

DENGUE CONTROL

1. Paragraph 3, Memorandum No. 10, this Headquarters (Forward Echelon), 13 July 1944, is rescinded. Effective immediately, all new cases of dengue fever or suspected dengue fever, will be hospitalized in one of the hospitals now operating on this Island.

2. The number of new cases of dengue on 14 September was 422 and on 26 September it dropped to 75. This decrease is definitely linked with the control that has been established over mosquito breeding. A large area of this Island has been recently sprayed with DDT. A marked reduction in the incidence of flies and mosquitoes has been noted. Attention is invited to the fact that spraying with DDT is only one of the factors in dengue fever control. The attention of commanding officers is directed to the fact that the ordinary methods of mosquito and fly control are more necessary now than they were before the use of DDT if our efforts in control are to be continuously successful. DDT is still a critical item and its use must be reserved for emergency control. Commanding officers are directed to bend every effort toward the suppression of mosquito and fly breeding in their areas and will be held responsible that every possible effort is expended toward that end. Troops will not repeat not be allowed to sleep without the use of mosquito bars at any time. Frequent inspections will be made by responsible officers to see that these measures are carried out.

By command of Major General JARMAN:

G. M. O'CONNEL
Colonel, G.S.C.
Chief of Staff

OFFICIAL:

JAMES D. BAILEY JR.
Major, Adjutant General's Department
Adjutant General

DISTRIBUTION: E

TABLE 12.--Dengue

Saipan (APO 244)		
1944	No. of Cases	Rate per 1000 per Annum
September	3403	1143.15
October	221	84.50
November	30	10.26
December	7	1.75

TABLE 13.--Dengue

Saipan (APO 244)		
1945	No. of Cases	Rate per 1000 per Annum
January	6	1.81
February	8	2.18
March	4	.81
April	14	3.72
May	11	2.95
June	9	1.89
July	4	1.14

217TH MALARIA SURVEY DETACHMENT
APO 244

15 September 1945

SUBJECT: Filariasis on Saipan.

TO : The Surgeon, Army Garrison Force, APO 244.

1. Wuchereria bancrofti in Chamorros of Charan Kanoa, Saipan. Thick blood films (approximately 20 cmm of blood per slide) were prepared by this detachment on 125 adult Chamorros at 2100, 3 Mar 45. Twenty-five had microfilariae in their blood. Of these, 19 have spent their lives on Saipan and 6 were born on Guam. Slides made at various hours prove the microfilariae to be nocturnally periodic as follows:

Number of slides	Time	Average number of microfilariae per slide
32 (25 people)	2100 3 and 9 Mar	18
7 (7 ")	2400 9 Mar	43
7 (7 ")	0200 10 Mar	57.5
15 (15 ")	1200 11 Mar	.2

Microfilariae examined on fixed smears stained in hematoxylin showed the following characteristics proving them to be Wuchereria bancrofti: sheath present, tail gradually tapered to a point, no nuclei in tip of tail, excretory pore immediately anterior to excretory cell, body curved smoothly.

2. Wuchereria bancrofti in Japanese residents of Camp Susupe, Saipan. Of 100 adults (19 from Japan, 81 from Okinawa) examined 0200, 24 May 45, 3 were positive, with an average of 56 microfilariae per slide. These 3 are Okinawans: Inamine Seisho - Saipan last 5 years, Tinian 3 years, Okinawa before that; Irei Kosei - has been on Saipan 4 years, Carolines 3 1/2 years after leaving Okinawa; Gima Kamezo - Saipan 13 years, directly from Okinawa. Fixed slides stained in hematoxylin showed the microfilariae to be Wuchereria bancrofti.

3. Wuchereria malayi in Korean residents of Camp Susupe. Of 100 adults examined 0400, 23 May 45, 8 were positive, averaging 26 microfilariae per slide. These 8 people came directly to Saipan from Korea. 7 have been on Saipan for 4 years, 1 for 6 years. The microfilariae studied on fixed smears stained in hematoxylin had the following characteristics proving them to belong to the species Wuchereria malayi: sheath present, tail swollen into a knob at tip which contains 1 or 2 nuclei, excretory cell far posterior to excretory pore, body angular.

4. Clinical filariasis on Saipan. None of the natives found positive for microfilariae in the above surveys showed clinical symptoms of filariasis. However, several mild cases are on record at the US Navy Military Government Hospital #202. No troops on Saipan have contracted the diseases.

5. Wuchereria bancrofti in laboratory-reared Culex quinquefasciatus mosquitoes of Saipan. On 8 Aug 45, 0100-0200, 137 adult female Culex quinquefasciatus (raised in this laboratory) fed on Pedro Sablan, age 68, a resident of Charan Kanoa (Chamorro) who was born on Guam, and who has 105 Wuchereria bancrofti microfilariae per thick smear at 0200. A few mosquitoes were dissected each day for 20 days and slides prepared with the following results:

Day	Date	No. mosquitoes with infective larvae in proboscis	No. mosquitoes with larvae present but not in proboscis	No. mosquitoes with no larvae	Total mosquitoes dissected
1	8 Aug	0	4	0	4
2	9 "	0	4	0	4
3	10 "	0	4	1	5
4	11 "	0	3	0	3
5	12 "	0	3	1	4
6	13 "	0	5	1	6
7	14 "	0	4	0	4
8	15 "	0	4	0	4
9	16 "	0	4	1	5
10	17 "	0	1	2	3
11	18 "	1	6	0	7
12	19 "	2	2	0	4
13	20 "	8	3	1	12
14	21 "	4	3	2	9
15	22 "	7	2	3	12
16	23 "	4	1	0	5
17	24 "	2	3	0	5
18	25 "	5	3	1	9
19	26 "	5	0	0	5
20	27 "	13	6	8	27
Totals for 20 days:		51	65	21	137
Totals for 11th-20th d:		51	29	15	95

Infective stage larvae reached the proboscis by the 11th day of development. Of the 95 mosquitoes dissected from the 11th-20th day, 51 (53.7%) had these worms in the proboscis and could have infected a human with filariasis. The rest either had no worms (15) or had

worms in the abdomen, thorax, head or antennae, but not in the proboscis (29). The number of worms occuring in the proboscis ranged from 1-5, averaging 1.7. The average number of worms in all parts of positive mosquitoes was 6.9, ranging from 1-40. In large mosquitoes having an excessively large blood meal, all the blood was not digested for three days. In such mosquitoes dissected on the 3rd day, undeveloped unsheathed motile microfilariae still were present in the blood remaining in the abdomen, 2nd day larvae occured in the posterior part of the thorax, and non-motile 3rd day larvae were found in the muscles of the thorax. This accounts for the frequent disparity in size of larvae from the same blood meal. It is evident from the above that Culex quinquefasciatus on Saipan is capable of transmitting filariasis. About half the mosquitoes feeding upon an infected person will be able to pass on the worms after they have completed their development in from 11-14 days.

6. Wuchereria bancrofti in wild mosquitoes of Charan Kanoa. 500 adult female mosquitoes were caught alive in native houses and air-raid shelters throughout the village of Charan Kanoa from 28 Feb-1 Mar and 29 Aug-11 Sep 45. All 500 proved to be Culex quinquefasciatus, a night-biting mosquito, and the only species found in dwellings at Charan Kanoa. All were dissected, slides prepared, with the result that 27 (5.4%) were found to harbor filaria worms of the following stages of development:

Mosquito slide	No. larvae		Place	Activity	Stage
#3	6		thorax	non-motile	7 day
#28	4	(1	"	"	2 day
		(3	"	"	6 day
#35	4		"	motile	1 day
#42	3	(2	"	non-motile	3 day
		(1	"	"	7 day
#45	4		"	"	5 day
#47	4		"	motile	infective
#49	1		"	non-motile	3 day
#55	2		"	"	3-7 day
#125	12		"	motile	6-9 day
#135	7		"	"	7 day
#157	4		"	"	6-8 day
#163	1		"	non-motile	4 day
#170	6		"	motile	1 day
#201	2		"	non-motile	3-4 day
#225	6		"	"	2-3 day
#248	3	(1	head	motile	infective
		(2	proboscis	motile	infective
#251	26	(1	thorax	"	1 day
		(25	"	non-motile	3 day
#296	1		"	"	5 day

Mosquito slide	No. larvae	Place	Activity	Stage
#297	2	thorax	non-motile	3-4 day
#334	3	"	"	2-3 day
#336	1	"	"	3 day
#364	3 (1	"	motile	1 day
	(2	"	non-motile	2 day
#415	20	"	"	7-8 day
#416	30	"	"	5-6 day
#463	5	"	"	3-4 day
#468	11 (5	abdomen	motile	1 day
	(6	thorax	"	1 day
#484	2	"	"	10-11 day

Only one mosquito had infective larvae in the proboscis, an incidence of .2%. It is evident, however, that Culex quinquefasciatus is a vector (at present the only one) of filariasis at Charan Kanoa.

7. Slides of larval filaria worms in all stages, and specimens of Culex quinquefasciatus have been sent to the Commanding Officer, 18th Medical General Laboratory, APO 957 for confirmation of the identifications and data above.

8. The following 19 photographs of slides prepared at this detachment are included in this report:

Fig 1 Rain-barrels in Charan Kanoa. These were formerly the principal breeding places of Culex quinquefasciatus. At present all are covered as shown on barrel to left.
Fig 2 Pedro Sablan.
Fig 3 Wuchereria bancrofti microfilaria X 540 from thick blood smear of native. Hematoxylin.
Fig 4 Microfilaria of W. bancrofti in human. X 150. Hematoxylin.
Fig 5 W. bancrofti 1st day in abdomen of Culex quinquefasciatus. X 150. Hematoxylin.
Fig 6 2nd day in thorax, hematoxylin, X 150.
Fig 7 3rd " " " " "
Fig 8 4th " " " " "
Fig 9 5th " " " " "
Fig 10 6th " " " " "
Fig 11 7th " " " " "
Fig 12 8th " " " " "
Fig 13 9th " " " " "
Fig 14 9th " " " " "
Fig 15 11th " " " fixed, unstained, X 150.
Fig 16 15th day, living, in proboscis, X 150.
Fig 17 " " " " " " same mosquito as #16.

Fig 18 15th day, living, in proboscis, X 150, same mosquito as #16.
Fig 19 " " fixed, emerged infective larvae, X 150.

/s/Robert S. Beam
ROBERT S. BEAM
1st Lt Sn C
Entomologist
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/s/Joe T. Marshall, Jr.
JOE T. MARSHALL, JR.
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CHAPTER XV

Miscellaneous Infections

A rather large number of cases of jaundice were admitted to hospitals and the number were particularly great during the time that dengue was prevalent. Studies were made of the cases of jaundice in an effort to establish its etiology and any correlation with dengue, but the only pertinent information available showed that (a) the specific type and cause of the jaundice has not been determined, (b) there is no apparent correlation between the appearance of jaundice and the administration of any serum or vaccines, (c) Leptospira have been demonstrated in the sterile urine of two cases.[31] (See tables 14 and 15, jaundice.)

TABLE 14.--Jaundice

Saipan (APO 244)		
1944	No. of Cases	Rate per 1000 per Annum
September	126	42.28
October	19	7.25
November	13	4.44
December	5	1.24

TABLE 15.--Jaundice

Saipan (APO 244)		
1945	No. of Cases	Rate per 1000 per Annum
January	1	.30
February	5	1.32
March	4	.81
April	7	1.86
May	14	3.75
June	18	3.77
July	10	2.84

CHAPTER XVI

Diphtheria

Diphtheria was rare in the Western Pacific Base Command except for a short time on the island of Saipan when it appeared that an epidemic was threatening. The first case was diagnosed on 15 July 1944 and between 15 August and 15 November a total of 69 cases were diagnosed. Strict control measures were immediately instituted and a search was made for any existing cutaneous diphtheria and the threatened epidemic was avoided. All cases were sporadic and incidence in any one organization was not sufficiently high to be of epidemic proportions.[32]

CHAPTER XVII

Nutritional Diseases

There are no nutritional diseases to report.

CHAPTER XVIII

Environmental Diseases

There are no environmental diseases to report.

CHAPTER XIX

Extra-Military Sanitation and Liaison Activities

The Civil Affairs was organized by and under the control of the Navy but liaison was kept between the Army Medical Inspectors on islands of Army command.

The destruction of practically all civilian establishments, institutions and facilities was complete due to the ravishes of war and the civilians only gradually and with considerable apprehension turned themselves into the U. S. Civil Affairs. The personnel and supplies for the care of the civil population was at first but meager and the best had to be made out of an almost impossible situation. Safe areas were set aside for the civil population and the construction of shelter out of remaining scrap was undertaken. In due time the construction of some form of shelter was accomplished as were sanitary facilities.

Since the use of night soil was universal, flies abundant, and living conditions very crowded, the institution of sanitation was a major problem. Deep pit latrines, washing and bathing areas were constructed and supervision of sanitation and supply of food and clothing was instituted.

At first, the deep pit latrine was the only practical method of disposal of human waste and this was maintained sanitarily only with great difficulty. The lumber and tin used in the construction of the latrines had to be guarded or the civilians would take the building apart and use the material for further improvement of the home. The enforcement of proper sanitation regarding use and maintenance of the latrines also proved to be a major detail, but the sanitary detail that was formed proved successful. The maintenance of the latrine fly control could only be effected by the use of sodium arsenite at first as the number of latrine seats was inadequate and the latrines were in constant use. (See figure 7.) In due time a water borne sewage system was constructed to accommodate about 2000 persons and this lessened the load on the overtaxed pit latrines. The water system consisted of a wooden fly proof building over a concrete pit that was flushed along piping that lead to a septic tank. Maintenance of these units proved comparatively easy. (See figure 8.) As the latrine seats became more adequate and the people were better trained, sodium arsenite was discontinued and the use of latrine oil spray proved to be adequate for fly control.

Round concrete decks with an adequate lip and drain were installed for the purpose of washing and bathing. Water was supplied by a shallow well and the water was drained by means of open ditching. (See figure 9.)

Housing varies depending upon the amount of destruction and on the island of Saipan the Chamorros lived in the village of Charan Kanoa and occupied the civilian homes that existed prior to the invasion. About one-third of the population lived in barracks constructed after the invasion and the remainder lived in Camp Susupe in the originally built houses that were somewhat improved. (See figures 10 and 11.)

Except for the Chamorros who lived in family groups, food was prepared in public kitchens which were closely supervised. (See figures 12 and 13.)

Due to extreme adverse conditions and the lack of personnel, supervision of sanitation was at first almost impossible but gradually an organized sanitary detail evolved. With employment and training of civilian personnel, the sanitation improved satisfactorily and has progressed to a high degree. (See figure 14.)

Typical Early Latrine

Inside View

Figure 7

Water Borne Latrine

Inside View

Figure 8

Concrete Deck for Washing & Bathing

Figure 9

View of Housing, Camp Susupe

Barracks in Korean Camp

Figure 10

Interior View of Housing, Camp Susupe

Interior View of Housing at Korean Camp

Figure 11

Exterior View of Kitchen, Camp Susupe

Interior View of Kitchen, Camp Susupe

Figure 12

Interior View of Kitchen, Camp Susupe

View of Kitchen at Korean Camp

Figure 13

Sanitation Headquarters, Camp Susupe

Figure 14

CHAPTER XX

Civil Public Health[33,34,35]

Due to the ravages of war, the civilian population was found to be in dire circumstances at the time the islands were occupied. This was most markedly manifested on the island of Saipan since the combat phase was of longer duration. The natives were found to be homeless, without food, and in general, in a poor state of health. During the early phase of occupation the death rate was markedly high, sanitary facilities non-existent and due to the lack of adequate personnel to treat the sick and injured and render general care to the needy a state of chaos existed. The Military Government and the field medical units assisted in the care of the civilian and in due time order was restored and people were fed and the sick and injured adequately cared for. As the occupation progressed, living conditions and medical care improved and the health of the civilians progressed comparably. Since adequate records are not available for a discussion of the total civilian health picture and the author is familiar with the situation on Saipan from personal experience and hearsay, the following discussion will pertain specifically to Saipan. It should be pointed out that the picture of the civilian condition on other islands, while comparable, was not identical with that found on Saipan due to the existing condition and the length of the campaign.

Hospitalization was first established by the medical field units and later by the station hospital assigned to the island which in turn was relieved by a Navy G-4 hospital the latter part of January 1945.

The nutrition of the natives at the time of the occupation was extremely poor and accounted for a considerable number of the hospital admissions and deaths in the first few months. While specific clinical diagnoses were not established, marked malnutrition was evident in most people.

The total population including Chamorros, Koreans, and Japanese was about 20,000 and the death rate was at first very high but gradually declined as adequate housing, food, and sanitation were effected. The following is a rough summary of the death rates per month:

During the months from June 15 to September 1, there was an average of about 800 deaths per month.

September	508
October	225
November	98
December	65

This rate gradually declined and a new low was established during October when only 40 deaths occurred.

Scabies at first was almost universal but this condition cleared in spite of the fact that possibly but about 5 percent of the people were treated for the condition.

While yaws was very prevalent among the Chamorros it was rather uncommon among the Koreans and Japanese and this is believed due to the fact that only the Chamorros were natives of the island. The Chamorros showed almost 100 percent evidence of yaws while there were but 10 cases among 13,000 Japanese. The high rate of positive Kahn tests among the Chamorros varied considerably on a small number of repeated tests and while there was considerable clinical evidence of yaws among them, the positive blood was believed to include a number of false positives.

Intestinal parasitism was extremely common and the following chart is rather representative.[36] This chart was prepared by the 217th Malaria Survey Detachment.

30 Japanese Civilians

Name of Parasite	Number of People Positive
Hookworm ova	19
Ascaris lumbricoides ova	18
Entamoeba coli	15
Trichuris trichiura ova	14
Endolimax nana	8
Strongyloides stercoralis larvae	3
Small flagellates	2
Entamoeba histolytica	2

One of the cases of Entamoeba histolytica had the pathologic type of infection characterized by bloody stool, and large amebae containing ingested red blood cells. The other had only the small type of ameba without ingested red blood cells and with a normal stool.

62 Japanese Orphans (previously treated for worms)

Name of Parasite	Percent of Orphans Infected
Hookworm ova	68.5%
Strongyloides stercoralis larvae	64.5%
Trichuris trichiura ova	45.7%
Entamoeba coli	42.0%
Pentatrichomonas hominis	27.4%
Endolimax nana	17.7%
Entamoeba histolytica	17.7%

Name of Parasite (Cont'd.)	Percent of Orphans Infected
Giardia lamblia	14.5%
Ascaris lumbricoides ova	8.5%
Hymenolepis nana ova	2.8%
Chilomastix davainei	1.6%
Iodamoeba butschlii	1.6%

Eleven children (17.7%) had Entamoeba histolytica but none of these had bloody stools. In all 11 cases, the amebaes were of the small type which did not contain red blood cells, and are apparently non-pathogenic.

The incidence of tuberculosis was high and the following statistics based on x-ray evidence of active tuberculosis gives an idea of the prevalence:

Hospitalized patients with chest pathology	25%
Orphans	8%
Picked healthy civilians	2%
General population (routine hospital admission)	10%

Universal vaccination for smallpox and typhoid was carried out and the following is a report of smallpox take:

Chamorro children	37%
Chamorro adults	59%
Japanese children	53%
Japanese adults	52%
Korean children	17%
Korean adults	3%

The absence of some diseases is of interest and the following is a summary of the diseases not encountered:

Ulcers
Hypertension
Arteriosclerosis
Tonsillitis
Arthritis
Appendicitis (rare)
Malignant diseases (rare)
Pelvic diseases
Pernicious anemia
Psychosis
Venereal diseases (rare or absent)

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